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VIII. *Remarks on the tendency to Calculous Diseases ; with observations on the nature of urinary concretions, and an analysis of a large part of the collection belonging to the Norfolk and Norwich Hospital. By JOHN YELLOLY, M.D. F.R.S. &c.*

Read June 19, 1828.

HAVING, since my residence in the neighbourhood of Norwich, and my connection with the county hospital, paid considerable attention to calculous diseases and their concretions, I beg leave to lay some observations on those subjects before the Royal Society, to whose Transactions we owe much valuable information on the branches of pathology which relate to urinary complaints.

PART I.—*Of the tendency to Calculous Diseases.*

The county of Norfolk has long been remarkable for the occurrence of calculous diseases among its inhabitants ; but there are no means of ascertaining how far this disposition extended, previous to the establishment of its hospital in 1772. Many of its cases went, of course, to the metropolis before that time ; but there is, besides, every reason for concluding, that the operation of lithotomy was frequently performed in Norfolk, during all the preceding part of the eighteenth century, both from the reputation and extensive practice of Mr. GOOCH, one of the principal surgeons and surgical writers of his time, who lived near Norwich ; and the occasional observations made by that gentleman in his surgical works, as to the skill, and experience in lithotomy, of practitioners in different parts of the county.

Operative surgery does not indeed, at this time, appear to have been confined to the regular surgeon ; for in the little church of Stoke Holycross, about four miles from Norwich, is a mural monument of a clergyman, who died in 1719, and is represented, in an inscription surrounded by designs of various surgical

instruments, as having been distinguished for his abilities in theology, physic, surgery, and lithotomy*.

From the establishment of the Norfolk and Norwich Hospital in 1772, to the end of last year, making a period of fifty-six years, 649 operations of lithotomy have been performed in it, which is at the rate of rather more than $11\frac{1}{2}$ per annum, and about 1 in 40 on the total number of admissions, which amounted, in that period, to 26,521†. If we deduct from this number, the cases which have come from Suffolk and Cambridgeshire, amounting to 74, (of which, however, only a single instance has occurred from the latter county,) there will remain 575 furnished by the population of the county of Norfolk, which amounts to 351,000; and this will produce about 10.26 cases per annum, or 1 for every 34,000 inhabitants.

The number of cases arising in Norwich‡, in the same period, is 128, or about one fifth of the whole; while 447 are derived from the county of Norfolk, independently. Norwich, therefore, which contains 50,000 inhabitants, furnishes annually 2.28 cases on its population, or 1 for every 21,000 inhabitants; while the other parts of Norfolk afford only 7.98 per annum on their population of 301,000, or 1 for every 38,000 inhabitants, which is not much above one half of the proportion of Norwich.—Considerable differences likewise exist, with regard to the ratio of numbers furnished by the different hundreds of Norfolk; the eastern parts of the county, however, contributing more largely than the western. Thus the six western contiguous hundreds, including Lynn, have furnished not more than one half of the proportion of the six eastern hundreds, including Yarmouth; and the difference is still more striking with regard to some of the individual hundreds; for the hundreds of Taverham, Tunstead, and Walsham (contiguous hundreds on the eastern parts of the county), have regularly furnished about five times the proportion of the contiguous western hundreds of Freebridge Marshland, Freebridge Lynn, and

* *Memoriæ Sacrum THOMÆ HAVERS, Clerici, qui Theologiâ, Medicinâ, Chirurgiâ, et Lithotomiâ, doctus fuit et peritus &c.*

† The hospital contains about 100 patients, and averages about 80.—I have adopted the census of 1820 in my calculations, and have usually put aside the hundreds.

‡ With Norwich I include, as is usual, what is called the County of the City of Norwich, a district which extends, in one direction, about two miles from the city, and in the others, from half a mile to a mile.

South Greenhoe ; which proportions have been pretty much preserved, during every part of the period to which the records of the establishment extend.

It is to be observed, however, that there are some singular anomalies on this subject ; for in a few instances it has happened, that a particular hundred has been remarkably free from the disease, and that the contiguous one has afforded rather an unusual number of examples of it.

There has been no material alteration in the number of cases which have occurred, in a similar space of time, during the different periods since the establishment of the Norfolk and Norwich Hospital; and hence, as the population of the county has augmented nearly a third during that period, the proportion of calculous cases may be considered as having diminished much in the same ratio.

With regard to the proportion in which calculous cases occur in other parts of the kingdom, the researches of Dr. DOBSON*, and afterwards of Dr. MARCET†, and Mr. SMITH of Bristol‡, have communicated the principal information which we possess upon the subject : but it is exceedingly difficult, from the want of efficient registers, to procure such data, as can connect the occurrence of a certain number of cases, with a certain known population. Mr. SMITH's calculation, of the occurrence of about 47 operations for calculus annually in the hospitals of the metropolis, I believe to be pretty nearly the truth ; and I have found from the registers of the London Hospital, (to which I was many years physician,) that in that establishment, about two thirds of the calculous cases have been furnished by the metropolis, and one third by the country. Taking the same proportions as applying to the other hospitals of the metropolis, I am therefore disposed to refer 31 of the 47 cases, to the population of the metropolis, amounting to rather more than 1,200,000 inhabitants ; and 16 to about the same number living in counties adjacent to the metropolis, which possess no county hospitals, or have had them too recently established to affect

* Medical Commentaries, &c. with Observations on the Disposition to the Stone in the Cyder Countries, compared with some other Parts of England.

† Essay on the Chemical History and Medical Treatment of Calculous Disorders.

‡ A Statistical Inquiry into the Frequency of Stone in the Bladder in Great Britain and Ireland. Medico-Chirurgical Transactions, vol. xi. p. 7.

the calculation*. It would seem probable from this rough estimate, that 1 case of operation for calculus occurs annually for every 38,000 inhabitants in the metropolis, and about half that proportion in the counties contiguous to it.

From the information which Mr. SMITH has furnished, it appears that about 60 operations of lithotomy are performed annually in the provincial hospitals of England. This estimate includes Wales, whose sick poor, when sent from home, are chiefly transmitted to the hospitals of one or other of the adjoining English counties, as there are no such charities in the principality.—Suffolk did not possess a county hospital when Mr. SMITH was prosecuting his researches; and consequently was not included in his calculations, except as far as it furnished cases to the Norwich, or other hospitals. It possesses, however, in an eminent degree, the calculous character of Norfolk; and I have been enabled, through the kindness of some professional friends, to estimate the operations of lithotomy performed in it, by private practitioners, during the last 20 years, as about 4 annually. If this number be added to 1.26, (which is the annual proportion of 73 admissions from Suffolk to the Norwich Hospital in 56 years,) we shall have 5.26 cases as the annual product of Suffolk on its population of 234,000; or 1 case for every 44,000 inhabitants. It may be remarked, that the want of an hospital in Suffolk, till within these few years, and its distance, both from Norwich, and London, have occasioned the performance of a much larger proportion of operations of lithotomy in that county, by private practitioners, than is usual in other districts.

According to Mr. SMITH's calculation, there will therefore be 107 public operations in the whole of England and Wales, which, with the addition of 4 from Suffolk, will make 111 operations annually, on a population of very nearly 12,000,000, or 1 case for every 108,000 inhabitants. This, however, is not quite a third of the proportion which occurs in Norfolk.

If we put aside from the calculation, the $15\frac{1}{2}$ cases occurring in the Norfolk district, (comprehending Norfolk and Suffolk) with its population, we shall then have 1 calculous case for every 118,000 inhabitants, independently of that

* Middlesex, Essex, Surrey, and Herts, may be regarded as hitherto principally dependent on the metropolis for Hospital accommodation; Kent, Sussex, Bucks, and Berks, as only partially so, perhaps to half their demand.

district. But if we further remove the cases which occur in London and the adjacent counties, with the respective population connected with them, we shall have not more than 49 examples of calculus attaching to the whole remaining population of England and Wales, or 1 case only, for every 188,000 inhabitants, which is little more than one fifth of the proportion of London, and of the Norfolk district excluding Norwich ; and only about one ninth of the proportion of Norwich itself.

The tendency of any particular class of persons to be affected with calculous complaints, in the kingdom at large, must therefore be exceedingly small. But if we take individuals between 14 and 50, (which is the most extended period of active exertion in adult age,) the calculous cases will be still further reduced ; for though it appears by the population returns, that nearly one half of the whole population of the kingdom, consists of persons between those ages, yet the calculous cases belonging to this period of life, as inferred from the Norwich register, are not quite a third of the total number. Under these considerations, I feel some degree of difficulty in completely assenting to the opinion which Mr. COPLAND HUTCHISON so ably supports*, of a sea-faring life being remarkable for the comparative infrequency of urinary calculi†.

In the Norwich as well as the London Hospital, the liability to calculous

* On the Comparative Infrequency of Urinary Calculi among Sea-faring People. *Medico-Chirurgical Transactions*, vol. ix. p. 443.

† By the register of the London Hospital it appears, that of 265 cases of calculus, which have occurred between the years 1761 and 1821, averaging $4\frac{1}{2}$ per annum, 12 were of sea-faring persons, making 1 in 22 of this class of persons, in the whole admissions. Of these, 2 were under 14 ; 4 between 14 and 20 ; 3 between 20 and 40 ; and 3 above 40. Mr. BORRETT, an eminent surgeon of Yarmouth, some years ago operated on a lad of 12 years of age, who was on his fishing voyage at Yarmouth, from the North of England ; and the same gentleman assisted Dr. TAIT, of the Naval Hospital there, about the year 1809, in an unsuccessful operation on a sailor, who was brought on shore, under great suffering, from a ship of war at that time lying in the roads. These are all the instances with which I am acquainted, of the occurrence of calculus in sea-faring persons ; for the register of the Norfolk and Norwich Hospital does not afford any evidence on the subject, as it is only of late years, that the occupations of patients have been inserted in it. Without such an aid, I should feel it to be impossible to speak from recollection, as to the occupations of public patients, even if they had been known at the time of admission, which could be very seldom, and only incidentally the case.—The occurrence, according to Mr. HUTCHISON's interesting paper, of 6 cases of lithotomy in 15 years, in a naval population of 160,000, will be in the proportion of .4 per annum, or 1 in 400,000 persons. But if we put aside the London and Norfolk districts, as being more than ordinarily liable to the complaint ; and comprise Scotland and Ireland in the calculation, which

diseases has been nearly as great, during the first sixteen years of life, as in the whole after period ; but if we take the cases afforded by Norwich and London, independently of their respective country districts, as many cases of calculus have occurred below 14, as above that age ; so that in those two instances, the proportion of children affected with this complaint, (judging from the hospital returns,) has been larger in a town, than in a country situation.

With regard to the mortality from the operation of lithotomy, the number of deaths in the Norfolk and Norwich Hospital, has been 89, which is a mortality of 1 in 7.29 cases, from the institution of the charity. But it is creditable to the state of modern surgery, and to the skill of the present surgeons of that Hospital, that in the operations performed by them (which amount to near one third of the whole number from the commencement), the proportion of deaths has been reduced to 1 in 8.42, which differs very little from the average of CHESELDEN, whose improved lateral operation they follow*.

afford their full complement of men to the British navy, but have less tendency to calculous diseases, according to our present evidence, than England ; it will not be found, even if we take the smaller population of 1810, instead of that of 1820, that the proportion of those complaints, among large bodies of natives of the three kingdoms, between 14 and 50 years of age, acting together, will differ much from that stated by Mr. HUTCHISON.

* CHESELDEN is generally considered as having lost only 1 patient in $10\frac{1}{2}$, in his hospital lithotomy practice ; but the summary referred to, of 20 deaths in 213 cases, applied only to the success of his improved lateral operation. As far as existing documents afford evidence on the subject, (Anatomy, book iv. chap. 6 ; and Treatise on the High Operation, p. 17), that great surgeon, who was distinguished for candour and ingenuousness, lost, previously, 8 cases out of 28, which raised the average mortality of his hospital practice to 1 case in 8.6. His great success was in children ; for the statement given by him, evinces his mortality to have been 1 in $5\frac{1}{2}$, of even his most successful operations, in persons above 14. I may likewise remark, that it was foreign to CHESELDEN's plan, to notice any operations, but those immediately connected with his historical view of lithotomy ; and he did not therefore record, in his publications, the number or result of any which occurred to him in St. Thomas's Hospital, between the time of his appointment to that charity in 1718, and his first mentioned high operation in 1722.—It is also important to bear in mind, in referring to CHESELDEN's mortality, that some of the patients who were included among his successful cases, were carried off by small-pox, in the Hospital, before their complete recovery. He gives it as his opinion, indeed, that such deaths were not in greater proportion, than might be expected to have occurred from small-pox alone ; and the well-known uprightness of his character, entitles this opinion to every degree of credit. Hence, in strict correctness, they do not affect the accuracy of his general statement. In the Norfolk and Norwich Hospital, however, it is the invariable practice, for no case to be put down as a recovery from the stone operation, if the patient die in the hospital, of any disease which may even have come on during his convalescence.

Up to the age of 14, the deaths are only 1 in $14\frac{1}{2}$; and above that age, 1 in $5\frac{1}{4}$. Between 14 and 40, the mortality is 1 in $10\frac{1}{2}$; but after that period of life, it is augmented to the formidable extent of 1 in $3\frac{3}{4}$.

The number of female cases, in the whole, has been 31; the proportion, 1 in 20; and the deaths 1 in $15\frac{1}{2}$. But from the improved practice by dilatation, all risk of life, in the abstraction of calculi from females, seems to be taken away. I have mentioned, in the Medico-Chirurgical Transactions, the removal from a female of a calculus of nearly $3\frac{1}{2}$ oz. troy, in weight, by spontaneous dilatation*; and some examples are given in the Philosophical Transactions, by Dr. MOLYNEUX, Dr. HEBERDEN, and others, of a similar kind: but it was not till of late years, that dilatation was employed to supersede the usual operation of lithotomy in women.

The following Tables will exhibit, at one view, the number of operations of lithotomy at the Norfolk and Norwich Hospital, with the mortality, at different periods of life.

Age or Sex.	Operations.	Cured.	Died.	Mortality.
Both sexes . . .	649	560	89	1 in 7.29
Males	618	531	87	1 — 7.1
Females	31	29	2	1 — 15.5
Both sexes.				
Under 14 . . .	292	272	20	1 — 14.6
14 and upwards	357	288	69	1 — 5.17
14 to 40	155	140	15	1 — 10.33
40 and upwards	202	148	54	1 — 3.74
14 to 50	196	171	25	1 — 7.84
50 and upwards	161	117	44	1 — 3.56
Under 16 . . .	317	294	23	1 — 13.78
16 and upwards	332	266	66	1 — 5.03

* Vol. vi. p. 574.

Age.	Operations.	Cured.	Died.	Mortality.
Inf. to 10	255	237	18	1 in 14.16
10 — 14	37	35	2	1 — 18.5
14 — 20	62	55	7	1 — 8.85
20 — 30	47	42	5	1 — 9.4
30 — 40	46	43	3	1 — 15.33
40 — 50	41	31	10	1 — 4.1
50 — 60	92	69	23	1 — 4
60 — 70	63	43	20	1 — 3.15
70 — 80	6	5	1	1 — 6

The operation of lithotomy is always attended with more danger, when calculi are large, than when they are small. This has been strikingly exemplified at Norwich ; for of 52 cases of adult males, in which calculi of 2oz. or more occurred, 31 died, or nearly 2 in 3 ; while in 282 cases, also of adult males, in which the stones weighed less than 2oz., the mortality only amounted to 37, or rather less than 1 in 7. Part of this unfavourable issue, is no doubt to be attributed to the injury, both local and constitutional, which the long continuance of a large calculus in the bladder may occasion ; but, at the same time, when we consider the general hazard of the operation of lithotomy, even in the most skilful and experienced hands, and the injury produced by the force necessary for extracting a calculus, and particularly a large one, there is a strong inducement afforded, to the full and dispassionate examination of the mechanical means which have been suggested, either for diminishing the magnitude of calculi, during an operation, in the revived and improved method of Mr. HENRY EARLE*, or for wearing them down, by slow and gradual detrition, according to the plan which has been employed at Paris by M. CIVIALE, so as in many cases to do away with the necessity of the operation altogether†.

The circumstances which occasion death after the operation of lithotomy, form an important and interesting subject of investigation to the surgeon ; and

* Med. Chir. Trans. vol. xi. p. 69. † Dela Lithotritie, ou Broiement de la Pierre dans la vessie.

I am inclined to think, that in addition to the unforeseen and unavoidable occurrences, which sometimes succeed the very best exertions of surgical skill, there is something to be attributed to the constitutional shock of a great operation, under which the system will occasionally sink. It is, however, a consideration, that may abate undue confidence from early success, on the one hand, and offer consolation and encouragement, under unexpected failures, on the other, that of two of the most distinguished contemporary lithotomists of this country, whose qualifications were of the most respectable kind, one lost 3 patients only of his first 50 operations, or 1 in $16\frac{2}{3}$; and 1 in $4\frac{3}{4}$ of the remainder, amounting to more than double, so as to reduce his average mortality to rather below 1 in 7; while the other lost 11 of his first 50 patients, or 1 in $4\frac{1}{2}$; and in his remaining cases, which a good deal exceeded those in the former instance, lost only 1 in $13\frac{3}{4}$, so as to render his whole average mortality rather less than 1 in 8*.

Recurrences of stone seem to be not very frequent; 14 instances, or 1 in 46 only, being found in the records of the Norfolk and Norwich Hospital, of the operation having been performed twice on the same individual: 3 were below 14, and 9, (of whom 2 died) above that age. The production of the second calculus took place, in 4 of these cases, within 1 year; in 5, within 2 years; in 3, within 3 years; while in the 2 remaining cases, the operation did not become again necessary, till after a lapse, respectively, of 7 and 10 years.

It does not appear that a second calculus is necessarily of the same character as the first. In the child from whom the first known specimen of cystic oxide was extracted, (that analysed by Dr. WOLLASTON), the disease returned; but a second operation was not submitted to. The child died, when a calculus, of a different character from the original one, was found in the bladder.

A curious example, of a similar kind, was shown to me at Cambridge, by Mr. JOHN OKES, one of the surgeons to the Cambridge Hospital, of a calculus

* The examples occurred in the Norfolk and Norwich Hospital; and the gentlemen alluded to, were the late Dr. RIGBY (formerly senior surgeon to that establishment), and the late Mr. MARTINEAU. —I lament to say, that the death of the latter gentleman has taken place since my paper was laid before the Society.—The whole number of Dr. RIGBY's hospital operations was 106, with 15 deaths; and of Mr. MARTINEAU's 147, with 17 deaths. Mr. MARTINEAU dated his principal success (*Medico-Chir. Trans.* vol. xi. p. 402.) from the time that he employed the blunt gorget, according to CHESelden's method; Dr. RIGBY, as far as I have had an opportunity of ascertaining the point, always used the blunt gorget.

of cystic oxide having a lithic nucleus, which was removed from a boy of 4 years old, and was followed, in a short time, by the formation of another of fusible exterior, with a lithic interior, which made a second operation necessary in less than a year from the first. So speedily may the character of the animal process be changed, on which the formation or augmentation of urinary concretions depends.

With regard to the respective number of calculous cases which occur among the lower and higher orders of society, it is necessarily very difficult to obtain any correct information. Mr. MARTINEAU, however, the senior surgeon of the Norwich Hospital, one of the most eminent and successful lithotomists of the present day, laid before the public, some years since, with much valuable information on the subject of lithotomy, a list of private patients, amounting to 10 in number, upon whom he operated, during a period that he operated on 111 public patients*. The proportion was 1 private patient to 11 public; which differs not much from the results of the late Mr. BRANDON TRYE of Gloucester, as given in Mr. SMITH's paper.

I regret that but little advances have been made, in a knowledge of the circumstances on which a tendency to calculous complaints depends; and I am not aware of such differences of air, water, soil, or habits of life having yet been detected, as can justify us in attributing the prevalence of stone, in the Norfolk district, to any of those causes.

A constitutional predisposition to the occurrence of calculous diseases, unquestionably exists in certain families. Dr. PROUT, in his valuable work on Urinary Diseases, mentions an instance of a calculous tendency in three continuous generations; and I am acquainted with a family, where the grandfather, a man of active habits living in the country, was twice cut for the stone, and died from the second operation; the father was also cut; and two of the sons have exhibited an unequivocal calculous disposition, from an early period of life. I may also observe, that a few examples have occurred at the Norfolk and Norwich Hospital, where more than one individual of a family has had the disease, and undergone the operation.

The large employment of ill fermented farinaceous food, which marks in some degree the habits of the commonalty of Norfolk, may perhaps be regarded

* On Lithotomy. Medico-Chirurgical Transactions, vol. xi. p. 402.

as favouring the occurrence of calculous diseases ; but a much coarser, and worse fermented material, in rye, barley, oats, and various mixtures of peas, with wheat or barley, has been, and perhaps still continues, to a certain degree, in use in Scotland, and the North of England, without being productive of such an effect. There are doubtless, however, various collateral circumstances that have not been sufficiently ascertained, which may have the power of modifying the effects of any particular description of food ; and it is even very probable, that the laxative tendency of some of the coarser kinds of farinaceous aliment, may have a salutary influence, and obviate the disadvantages which might otherwise arise from their employment.

The cyder counties were at one time supposed to be peculiarly liable to calculous complaints ; but so little ground is there for this opinion, that Herefordshire seems to have a very peculiar exemption from that malady ; and Devonshire, not to have more than the average cases of other counties.

From the documents to which I have referred, it appears, that the tendency to produce calculus, is much greater in Norwich, and London, than in their respective country districts*. The same circumstance is very strikingly exemplified in Bristol ; for according to Mr. SMITH's paper, to which I have had occasion so frequently to refer, 354 calculous cases have occurred in 82 years, at the Bristol Hospital, which is at the rate of 4.3 per annum. But of these, 173, or very nearly one half, were derived from Bristol and its liberties, which comprise a population of 87,000 persons ; and 181 only, from the neighbouring districts, containing not less than 750,000 inhabitants†. The annual proportion would therefore be not less than 2.1 per annum for Bristol, which is 1 for 41,000 inhabitants ; while in its extensive and populous country district,

* I have mentioned the calculous tendency of Norwich, as being nearly double that of the county at large. Four of the eastern hundreds, however, viz. Taverham, Walsham, Tunstead, and Happing, rather exceed Norwich in this disposition ; having, in a joint population of 26,000, produced 75 cases of calculus, or 1.34 per annum. Those hundreds join each other ; and one of them, Taverham, abuts on the Norwich district.

† Bristol, owing to its central position, receives patients from the counties of Somerset, Gloucester, Wilts, and Monmouth, as well as from South Wales ; and I go upon the supposition (which I believe to be not far from the truth) that these districts transmit patients to the Bristol Hospital, in nearly an equal degree, with one or other of the hospitals of Bath, Exeter, Salisbury, Gloucester, or Hereford, according to local convenience.

the proportion would not be more than 2.2 per annum, or 1 only, for every 340,000 inhabitants.

In some parts of the country districts of Bristol, there are very singular anomalies; for the town of Chippenham, with only 3200 inhabitants, is stated by Mr. SMITH, to have furnished as many cases of lithotomy, as the whole remaining county of Wilts. On the calculation of 18 cases in 82 years, or 1 in 4.5, which is about half the amount furnished by Wilts, there would, in this little town, be a tendency to calculous complaints, exceeding by about a fourth, that of Norwich itself.

Scotland is generally regarded as but little liable to the production of calculous diseases; and if Mr. SMITH's calculation, of the occurrence of 8 cases only per annum, in that part of the island, is a correct one, it would, on its population of two millions, be in the ratio of 1 case for every 250,000 inhabitants. But the town of Dundee, in the county of Forfar, with a population of 30,000, has afforded to Mr. CRICHTON, of that place, in 36 years, 31 cases of stone, out of above 70 on which he operated during that period*. This is at the rate of .86 per annum, or 1 for every 35,000 inhabitants, if they had extended to that number. But if 5 are deducted, as having, from their designation in Mr. CRICHTON's list, the appearance of belonging to a higher class of society than enters into the calculations of this paper, we should then have .72 per annum, or 1 case for every 41,000 inhabitants, which is about the average proportion of Bristol.

In the instances which I have mentioned, it would therefore appear, that the tendency to produce calculous complaints, is greater in towns than in the country; and if this should prove to be the case generally, it would seem to indicate the existence, in children more particularly, of a connection between some diathesis which prevails in towns, (probably the scrophulous,) and the tendency to the secretion or deposition of lithic acid, on which the origin of urinary calculi so much depends. I have not had it in my power to ascertain, whether the greater disposition of towns to calculous complaints, applies more extensively than I have mentioned. I think it probable, however; but in some cases, in which I had expected to be able to connect the reports of the numbers operated upon, in a particular town or district, with a certain known

* Observations on the Operation of Lithotomy. Edin. Med. and Surg. Journal, vol. xxix. p. 225.

population, the records were not sufficiently ample to afford the requisite information. I did not therefore, avail myself of the well known kindness and courtesy of the medical officers of other provincial establishments, to trouble them with inquiries, which the plan of their registers might not, perhaps, give them the means of satisfying.

If I might venture, however, to make the suggestion, I would respectfully submit, how subservient our public hospitals, the boasts and ornaments of the country, might be made to important statistical inquiries, by a more extended system of registry, than is at present usually adopted, either in the metropolis, or in the country; and how conducive to pathological improvement, the information would be, which they might thus be so readily enabled to furnish.

The annexed Table will show the relation of calculous cases to population, in the principal instances which I have mentioned.

Place.	Population.	Number of Stone Cases.	Cases per Annum.	Comparative Frequency.
Norwich.....	50,000	128 in 56 yrs.	2.28	1 in 21,000
Norfolk, including Norwich.....	351,000	575—	10.26	1 — 34,000
Norfolk, excluding Norwich	301,000	447—	7.98	1 — 38,000
Suffolk	234,000	.....	5.26	1 — 44,000
Norfolk and Suffolk, including Norwich.....	585,000	.....	15.5	1 — 37,000
Norfolk and Suffolk, excluding Norwich	535,000	.....	13.33	1 — 41,000
London	1,200,000	.....	31.	1 — 38,000
Adjacent Counties	1,200,000	.....	16.	1 — 76,000
England and Wales	12,000,000	.....	111.	1 — 108,000
England and Wales, excluding Norfolk and Suffolk }	11,415,000	.....	95.5	1 — 118,000
England and Wales, excluding Norfolk, Suffolk, and London, with its adjacent counties }	9,015,000	.....	49.	1 — 188,000
Ditto persons between 14 and 50	4,134,000	.....	14.7	1 — 280,000
Bristol and its liberties	87,000	173—82 yrs.	2.1	1 — 41,000
Bristol country district.....	750,000	181—	2.2	1 — 340,000
Scotland.....	2,000,000	.....	8.	1 — 250,000
Dundee	30,000	26—36 yrs.	.86	1 — 41,300

Soon after the alkaline nature of Mrs. STEPHEN'S remedies for stone in the bladder, was made known by her in 1739, in consequence of the recompense of 5000*l.* adjudged by Parliament for the disclosure, it was found by Dr. HALES, that caustic alkalies had the power of dissolving calculi out of the body. But Dr. RUTTY*, and some years afterwards Dr. DAWSON†, discovered that this substance was limited in its operation, to certain descriptions of calculi; while others were capable of being dissolved by nitric or muriatic acid alone; and hence they concluded, that in the latter cases, acids might be regarded as important lithontriptics. The subject, however, was not pursued; and these experiments, with the curative deductions made from them, were entirely lost sight of.

The precise nature of lithic acid was afterwards discovered by the celebrated SCHEELE; and for a long period subsequent to his time, urinary calculi were uniformly supposed to consist of this material, and alkalies, alone, employed in the treatment of the diseases which they occasioned. It is singular, however, that the calculi which formed the subjects of that great chemist's experiments, as well as of BERGMAN'S, should have been so little varied, as not to have led to the observations which had been before made by Drs. RUTTY and DAWSON, and which would, in all probability, have opened the way to the further important discoveries in urinary concretions, which we owe, in so great a degree, to the perspicacity and talents of Dr. WOLLASTON.

In concluding the first part of the paper which I have the honour to lay before the Society, I would beg to observe, that I have put aside the consideration of private cases, except as regards Suffolk, because it is not likely that the proportion of these, will differ much, in different districts, from that of public ones.

I would also observe, that much valuable information with regard to the Norwich operations and collection, was brought forward by my able and excellent deceased friend Dr. MARCET, in his valuable work on Calculous Diseases, to which I have already alluded; but I have thought it desirable to present a general view of the whole subject, with such additional circumstances as I have had an opportunity of ascertaining.

* Account of some new Experiments and Observations on JOANNA STEPHEN'S Medicine for the Stone.

† On Human Calculi, showing them to be of different Kinds. Medical Transactions, published by the College of Physicians of London, vol. ii. p. 105.

PART II.—*Of Urinary Concretions.*

When I proposed an examination of the urinary calculi belonging to the Norfolk and Norwich Hospital, I had the expectation, that my attention would have been materially circumscribed by the previous labours of Dr. MARCET, who visited Norwich some years before, for the express purpose of examining the collection. I found, however, that none of the calculi contained in it were divided, and that the experiments instituted by our lamented colleague (of which an account was published in his work on Calculous Diseases,) were therefore necessarily confined to the outer surface, except in cases where the calculus had been broken in the extraction, and its interior structure thus allowed to be seen.

Within the last four or five years, a certain portion of the calculi have been divided; and these, as well as such as were broken in the extraction, amounting together to about 330, I have carefully analysed.

I wish I could have extended the examination over the whole collection, which consists of 649 specimens*; but as there is no very speedy prospect of the remainder being divided, so as to admit of a satisfactory analysis being made of them, I am unwilling, longer, to defer laying before the Society the results of my examinations, which exhibit a more extensive series of observations in this part of pathological chemistry, than has yet, as far as I know, been presented from any cabinet in this country. I shall be happy in embracing a future opportunity, of going through the whole remaining part of this splendid collection, should the division of the residue be effected within a convenient period. At the same time, however, it is not likely, that the proportions of the different descriptions of calculi which form the remainder, will differ materially from that of the large portion which I have analysed.—I have put the results of the analysis in a tabular form; and have stated, in the order of their occurrence from the centre, the consecutive deposits of the different materials of which the calculi are composed, according to the most prominent character of such material. I have said nothing of mixed calculi, or of calculi consisting, in the same apparent deposit, of mixtures of different ingredients; because it is

* This was the number up to the end of the year 1827. During the year 1828, there has been an addition of 11 specimens to the collection, from the occurrence of that number of operations.

well known, that no one deposit is strictly and unequivocally unmixed ; but is blended, in various proportions, with others, so as to undergo, by this means, more or less modification of character and appearance.

Calculi consisting principally of one deposit.

Lithic acid	81
Lithate of ammonia	20
Oxalate of lime	20
Phosphate of lime	4
Fusible calculus, or mixed phosphates ; that is to say, calculi composed of the triple, or ammoniaco-magnesian phosphate, united with phosphate of lime	37

Calculi consisting of two deposits.

Lithic acid and lithate of ammonia	37
—— oxalate of lime	11
—— mixed phosphates	10
—— phosphate of lime	2
Lithate of ammonia and lithic acid	2
—— oxalate of lime	25
—— mixed phosphates	14
—— phosphate of lime	1
Oxalate of lime and lithic acid	10
—— lithate of ammonia	1
—— mixed phosphates	15
—— phosphate of lime	3
Mixed phosphates and phosphate of lime	2

Calculi consisting of three deposits.

Lithic acid, phosphate of lime, and mixed phosphates	2
—— oxalate of lime, and phosphate of lime	1
—— oxalate of lime, and lithate of ammonia	2
—— oxalate of lime, and lithic acid	4
—— lithate of ammonia, and oxalate of lime	2

Lithic acid, oxalate of lime, and mixed phosphates	1
Lithate of ammonia, oxalate of lime, and mixed phosphates	3
—— oxalate of lime, and lithic acid	8
—— phosphate of lime, and lithate of ammonia	1
—— lithic acid, and mixed phosphates	2
Oxalate of lime, lithic acid, and lithate of ammonia	1
—— lithic acid, and oxalate of lime	1
—— lithic acid, and mixed phosphates	2

Calculi consisting of four or more deposits.

Lithate of ammonia, oxalate of lime, lithic acid, and mixed phosphates	1
Oxalate of lime, lithic acid, oxalate of lime, and mixed phosphates .	1
Lithate of ammonia, oxalate of lime, phosphate of lime, oxalate of lime, and lithate of ammonia	1
	328

In this table, it will be seen, that about one half of the specimens are composed of one description of material only; and that the remainder consist of alternating layers, more or less numerous, of most of the substances of which human urinary calculi are composed.—On each of these substances, I shall make a few observations.

Of lithic acid and lithate of ammonia.

The distinction between these substances, though very generally recognized abroad, does not appear to have been much attended to in this country, till it was noticed by Dr. PROUT, about nine years ago, in the *Medico-Chirurgical Transactions**; and afterwards, by the same gentleman, in his important and interesting work on *Calculus Disorders*. The existence of lithate of ammonia, as a frequent component part of calculi, was distinctly pointed out, under the name of urate of ammonia, by Messrs. FOURCROY and VAUQUELIN, in their paper on *Animal Concretions* in the *Annales des Chimie* for 1799†; but as they very singularly omitted all notice of Dr. WOLLASTON's celebrated communication on a similar subject, which appeared in the *Philosophical Trans-*

* Vol. x. p. 389.

† Tom. xxx. p. 57.

actions two years before*, it is not a matter of surprise, that the labours of these very eminent chemical philosophers, did not, in this department, obtain an authority in this country, which an appearance of greater candour would unquestionably have ensured them. Feeling, however, as I do, that Dr. WOLLASTON'S paper, even after a lapse of above thirty years of the most active and successful period of chemical investigation, is not only to be regarded as a model of elegant and accurate deduction, but as containing nearly every thing of importance which is yet known on the subject of urinary calculi, I must still do MESSRS. FOURCROY and VAUQUELIN the justice to state my conviction, that their operations were independent of those of our distinguished countryman. They were the first to notice lithate of ammonia; and their claim to originality may even derive some degree of support, from their having overlooked the most striking characteristic of the fusible calculus, noticed in Dr. WOLLASTON'S communication,—ready fusibility, notwithstanding they were aware of the existence, as separate substances, of both the sets of materials of which it is composed, and knew also, that these substances are frequently united. The subject, it is also to be observed, was not a new one with them; for it appears from a paper which was published in the *Annales de Chimie* for the year 1793†, that M. FOURCROY had been engaged, at various periods since the year 1787, in prosecuting researches into the nature of animal concretions, during which he materially enlarged the bounds of our acquaintance with those substances.

Several of the specimens in the Norwich collection, bear a close resemblance to the plate which M. FOURCROY gives of a calculus of lithate of ammonia‡. They are small, gray, and laminated; and in addition to the usual characters of lithic acid, elicit ammonia copiously, on the addition of pure potash. Like those mentioned by MESSRS. FOURCROY and VAUQUELIN, they are likewise generally derived from young subjects.

The combination of ammonia with lithic acid, is not, however, confined to small calculi, or to those which occur at an early period of life. It is to be found in calculi of all sizes, and belonging to all ages. But in such cases, ammonia invariably communicates a lighter colour, and diminishes the cohesion

* On Gouty and Urinary Concretions: *Philosophical Transactions* for 1797.

† Analyse Comparée des différentes Espèces des Concretions Animales et Vegetales, tom. xvi. p. 23.

‡ *Annales du Museum d'Histoire Naturelle*, tom. i. pl. vii.

of the calculus, as indicated on the addition of pure potash ; though there is not, except occasionally towards the centre, the laminated structure of early life. In a few instances, the appearance of the lithate of ammonia calculus is not very dissimilar to the chalk-like excrement, or rather urine of the *Boa Constrictor*, which, as is well known, consists of lithate of ammonia*.

Immersion, for a few days, in pure ammonia, converts yellow laminated lithic acid, whether in small masses, or in powder, into light-coloured lithate of ammonia, from which ammonia is readily evolved by the action of pure potash, after that which is loosely adherent, has been carefully separated by distilled water. But the artificial addition of ammonia does not, as far as I have observed, communicate any degree of decrepitation to a lithic calculus, as might be imagined from an observation of Dr. PROUT. It seems to be exceedingly likely, that some, at least, of the specimens of lithic calculus, which gave rise to SCHEELÉ's discovery of lithic acid in urinary calculi, really consisted of lithate of ammonia ; since we are informed, that in his original experiments, a disengagement of ammonia took place, during the solution of the subjects of his analysis in liquid caustic potash, which would not have been the case, if the lithic acid, on which he operated, had been pure and uncombined†.

* Dr. PROUT states to me, that he has never seen a calculus, essentially of lithate of ammonia, taken from a person after puberty ; and is of opinion, that there are at least two varieties of the combination of lithic acid with ammonia, if not more.—It is exceedingly likely, that it is owing to the different quantities of ammonia, with which lithic acid, according to this very probable idea, is capable of being combined, with some diversity, perhaps, in the admixture of other substances, that the varieties observable in the appearance of lithate of ammonia, in calculi, are to be attributed.

I have had occasion, since this paper was laid before the Society, to examine some very minute round calculi, which were put into my hands by Mr. DALRYMPLE, now senior surgeon to the Norwich Hospital. They were 59 in number ; were passed by a clergyman of about 54, all at once ; and though they amounted only to three-eighths of a grain in weight, they occasioned considerable suffering prior to their discharge. They were amorphous in the centre, and laminated externally ; and 35 were of very pure yellow lithic acid, the remaining 24, of gray lithate of ammonia, very similar in appearance to that which forms the lithate of ammonia calculus of children. They were formed, I have no doubt, in the kidney, and lay some time in its pelvis, before they were discharged. The circumstances of their occurrence resemble a good deal the cases mentioned in Dr. PROUT's work (p. 135) ; but in this instance it would appear, that the production of lithic acid, and lithate of ammonia went on at, or nearly at the same time ; and that adult age did not act as a bar to the formation of the latter. It is exceedingly likely, however, that the augmentation of any one of those minute calculi, if detained in the bladder as a nucleus, might not go on long with lithate of ammonia, except in early life.

† Chemical Essays of CHARLES WILLIAM SCHEELÉ, translated from the Transactions of the Royal Academy of Sciences at Stockholm : Essay 9.

One of the most able and experienced of our English chemists, Professor BRANDE, has been induced to infer, that the evolution of ammonia from calculi, which were regarded as consisting of lithate of ammonia, depends, in all instances, on the decomposition of the ammoniacal salts contained in such calculi, and more especially of the ammoniaco-magnesian phosphate, with which the lithic acid is united. As this is an interesting point in the history of those substances, I have made it a particular object of attention; and the following is the result of my observations.

After exposing calculi bearing the character of lithate of ammonia, either to alcohol or distilled water, whether cold or heated, I have never found that by the abstraction of any substance from them, which those fluids were able to carry off, the development of ammonia was at all diminished, on subjecting the remainder to the action of pure potash. When a portion of such calculi, either before or after exposure to alcohol or distilled water, was submitted to the action of acetic acid, none of the crystals of triple phosphate were to be observed on the addition of carbonate of ammonia to the filtered liquor, though the existence of that salt is capable of being detected, by this process, in the most minute quantity. By adding pure potash to the dried deposit which is obtained by evaporation from a solution of lithate of ammonia in boiling water, a copious development of ammonia took place, and the deposit itself was capable of undergoing complete solution in pure potash. It does not therefore appear, that in those instances, the evolution of ammonia depended on the decomposition of triple phosphate.

Mr. BRANDE has shown, that muriate of ammonia is capable of being obtained from lithate of ammonia; and hence, he thinks, that this substance is one of those, which may afford the ammonia supposed to characterize the lithate of ammonia calculus*. My experiments coincide entirely with those of Mr. BRANDE, as to muriate of ammonia being a constant component part of that description of calculus; but besides that this substance is in too small a quantity to give rise to the elicitation of ammonia, which occurs on the addition of pure potash to a lithate of ammonia calculus, the disengagement of ammonia

* A Letter on the differences in the structure of calculi which arise from their being formed in different parts of the urinary passages, and on the effects that are produced upon them by the internal use of solvent medicines, from Mr. WILLIAM BRANDE to EVERARD HOME, Esq. F.R.S. Phil. Trans. for 1808. p. 231.

takes place, with equal freedom, after the muriate of ammonia has been withdrawn from it, as before. I would also add, that on heating dilute muriatic acid on the calculus, from which muriate of ammonia has been withdrawn by distilled water, muriate of ammonia is formed, by the union of such muriatic acid, with the ammonia which is in combination with the lithic acid in the calculus; an increase in the weight of the calculus, when thoroughly dried, is found to have taken place; and the newly formed muriate of ammonia, is freely given up to distilled water. It is not only cognizable by its mode of crystallization, but by its ready sublimation; by the extrication of ammonia from it by pure potash; by the deposition of triple phosphate on the addition of magnesia and phosphoric acid; and the formation of luna cornea, through the means of its muriatic acid, on the addition of nitrate of silver.

The existence of muriate of ammonia in lithate of ammonia calculi, led me to inquire, whether, as that substance is always found in urine, some portion of it may not insinuate itself into the other species of calculi, and not be an attendant on lithate of ammonia alone. On examining various urinary concretions with a view to this point, I have always found that muriate of ammonia is distinctly traceable in common lithic acid. It likewise exists in calculi of the mixed phosphates, and in those of oxalate and phosphate of lime; and is also capable of being detected in that very rare species of calculus, the cystic oxide*. The quantity, however, is exceedingly minute; but though perfectly sensible to appropriate re-agents, it is incapable of being detected by any development of ammonia which pure potash can render evident, either to the senses or to vegetable colours.

From these circumstances I am disposed to infer, that the ammonia by which so many of the lithic calculi are distinguished, which have come under my notice, is usually in actual combination with lithic acid, and does not arise

* The distilled water which takes up muriate of ammonia from calculi, withdraws likewise a certain portion of the lithic acid, or lithate of ammonia, from which hardly any calculus, except, perhaps, the cystic oxide, is altogether free. The peculiar crystallization in which the cystic oxide is disposed to be thrown down, in combination with the triple crystals, (when the latter are produced by the addition of magnesia and phosphoric acid to water, which has been boiled over that curious substance,) may render the existence of the triple crystals a little doubtful. On dissolving the latter, however, by acetic acid, which does not touch the cystic oxide, the triple crystals become apparent on the addition of carbonate of ammonia.

from the decomposition of an accessory ingredient, as in the specimens analysed by Mr. BRANDE.

Lithate of ammonia, whether natural or artificial, bears a temperature much above that of boiling water without decomposition; for it does not part with its ammonia when exposed to the heat of melted tin, which requires a temperature of about 440° for its liquefaction. Its ammonia, or at least the greater part of it, is, however, readily yielded to any dilute acid, particularly on the application of heat; and from the nature and amount of the saline compound which is formed, the quantity of ammonia existing in the lithate, might, I presume, be ascertained.

The lithic calculi form, as is usual, the most numerous class of concretions in the Norfolk collection, where they amount to nearly a third of the whole number analysed. But when, in addition, we take those into account, which have lithic acid, or lithate of ammonia as a nucleus, it appears that nearly three-fourths of such number (namely 238 out of 328) either consist of the lithates, or have those substances as their nuclei.

The same observation may be made as to about two-thirds, or 27 out of 41, of the calculi belonging to the Cambridge Hospital, of which the kindness of Dr. HAVILAND, the Regius Professor of Physic, and my other medical friends of that flourishing and well-regulated establishment, allowed me the particular inspection.

In the collection of calculi belonging to the University of Leyden, which I had an opportunity of examining about two years since, by the courtesy of Professor SANDIFORD, 38 out of 49 specimens which it contained, or three-fourths of the whole, bore the character which I have just mentioned.

Dr. HENRY, of Manchester, published a valuable analysis in the Medico-Chirurgical Transactions some years since, of 187 calculi; and of those, 158, or five-sixths, were also either lithic calculi, or had lithic nuclei*. The evidence, therefore, which is derived from places far distant from each other, agrees as to the similarity in nature, of the primordia, of by far the larger proportion of urinary calculi; and evinces, that in appreciating the tendency to calculous disorders, and the means by which it is to be obviated, the attention

* Vol. x. p. 125.

must be particularly directed to the circumstances under which lithic acid is formed, or developed. The importance of this attention is put in a very striking point of view by Dr. PROUT, when he says, "that if a lithic acid nucleus had not been formed and detained in the bladder, two persons at least out of three who suffer from calculus, would never have been troubled with that affection."

A deposition of the phosphates, is not, according to Dr. PROUT's experience, followed by that of the other materials of calculi; and in this important particular, my observations, with hardly an exception, agree with his. Sometimes, indeed, I have seen little studs of lithic acid, or lithate of ammonia, imbedded in the mixed phosphates; but these appear to have descended from the kidney, as small calculi, and to have attached themselves to the phosphates during their existence in the bladder; for the laminated form which those phosphates often assume, is not interrupted under such circumstances, but only slightly altered in direction. Notwithstanding, however, the well marked character of the different species of urinary calculi, or their varied laminæ, there is still hardly a single deposit, with which a small portion of some of the other ingredients is not blended; a circumstance which probably arises, (as in the case of muriate of ammonia) from the readiness with which urine parts with a minute portion of most of its component parts.

Of oxalate of lime.

The calculus of oxalate of lime, has been generally designated as the mulberry calculus, from its resemblance, both in shape and colour, to a mulberry. Its appearance, however, varies from the darkest brown to a milk white, not differing much in colour from the fusible calculus. Its texture is generally tuberculated, or nodular; but this substance not unfrequently exists, in bright amber-coloured, or transparent white crystals, of the shape of flattened octohedrons. This form was noticed by M. FOURCROY, in concretions taken from the bladders of some animals, and was particularly observed by Dr. WOLLASTON, in three human calculi shown him by Dr. MARCET. There are not less than twenty examples, in the Norwich collection, of such crystallization: and I have seen a few examples elsewhere.—I had occasion to observe a similar form of crystal, in two or three small calculi of oxalate of lime, taken from the bladder

of a rat by a medical student some years since, and also in a calculus taken from the bladder of a pig. I have since found, that concretions of a similar description and form, are by no means uncommon in the former animal.

Of the triple phosphate, or ammoniaco-magnesian phosphate.

This substance is rarely found in its simple state, except as minute, transparent crystals, deposited between other laminæ. The nearest approach to it seems to be in the irregular white, or yellowish, or brownish-white crystallization, which is not unfrequently found on the surface of the mixed phosphates. This crystallization, I have always found to contain a small quantity of lime; and it must therefore, I presume, be considered, according to the division adopted by Dr. WOLLASTON, as belonging to the fusible calculi, or those consisting of the mixed phosphates, but possessing, perhaps, the smallest quantity of lime, which enters into the composition of this form of calculus. Dr. PROUT is inclined to view it as having some unknown, but regular proportion of the two sets of ingredients. The varying proportions, of the two phosphates seem, indeed, (as Dr. MARCET very judiciously observes,) to communicate every degree of fusibility to the calculi which are composed of them.

The usual mode of detecting minute quantities of the triple phosphate, is, I believe, that recommended by Dr. WOLLASTON, of observing the formation of a white line, by the deposition of the crystals of that substance, on any part of the glass vessel containing them, which has been rubbed by a glass tube, or other pointed instrument. I have employed, however, what appears to me a still more ready mode of ascertaining the formation of the triple phosphate, by placing the fluid expected to contain it, in a watch-glass, in the field of a compound microscope of moderate power. The triple crystals are thus capable of being observed at the period of their earliest formation; and their gradual increase of size, and union with each other in various accidental ways, but mostly in a stellated form, come within immediate view, and form an interesting subject of observation.—It is the more desirable to have a ready and unequivocal mode, of determining the existence of minute quantities of the ammoniaco-magnesian phosphate, in the examination of animal bodies, as the production of that substance affords a means, to which it is difficult to find a limit, of ascertaining the existence of ammonia, magnesia, and phosphoric acid.

Of phosphate of lime, and the mixed phosphates.

During my analysis of the Norwich collection, I was accidentally led to suspect that carbonate of lime, though very unusual in urinary calculi in a separate and distinct form, was not an unfrequent concomitant of phosphate of lime. A particular examination of the collection, with a view to this special point, convinced me that such was the case. The existence of carbonate of lime was evinced by effervescence, on submitting a portion of the powdered calculus, to the action of dilute muriatic acid, in a small tube, after boiling it in distilled water, to extricate the atmospheric air involved in it. The gas evolved, was readily absorbed by pure potash over water; while pure ammonia deposited the phosphate of lime, leaving a portion of fluid, from which lime was thrown down by oxalate of ammonia.—The same circumstance, likewise, happened, when the muriatic solution was evaporated to dryness, and the dried portion submitted to distilled water; the muriate of lime, formed by the solution of the carbonate being dissolved, and the lime precipitated in the form of oxalate, by oxalate of ammonia. Carbonate of lime, I have likewise seen in the mixed phosphates, and so extensively, as to induce me to think it probable, that phosphate of lime is seldom or never found in urinary concretions, either separately, or in combination with the triple phosphate, uncombined with carbonate. This circumstance seems to be the less unlikely, when it is considered, that carbonic acid gas has been found to exist in a pure state in urine, and separable by the mere aid of diminished atmospheric pressure. This being the case, it may fairly be expected to unite with some portion of lime during the evolution of the latter, instead of suffering the whole of it to be employed in forming oxalate, or phosphate of lime.

I am happy in having had the kind assistance of Dr. PROUT, and of Mr. FARADAY of the Royal Institution, in ascertaining the existence of carbonate of lime, in some of the specimens of calculi in which that substance is not usually looked for. To Dr. PROUT the circumstance was not unexpected; for he has long considered the existence of carbonate, with phosphate of lime in human concretions, exceedingly likely, though he had not put his ideas to the test of experiment.—An important confirmation of these observations I have likewise met with, in a paper by the distinguished Spanish chemist PROUST, who states,

that in every instance of urinary concretion which came under his observation, he found carbonate of lime, when there was phosphate*.

In one or two calculi of mixed phosphates which are in Dr. PROUT'S possession we found carbonate of lime; and the courtesy of Sir WILLIAM BLIZARD, the chairman of the Board of Curators of the Hunterian Museum, gave me the opportunity of making the same observation, in some of the specimens contained in that noble collection. I likewise had the particular favour from Dr. BENJAMIN BABINGTON, of not only examining with him, with the same result, several calculi of his small but valuable collection, (many of which are duplicates of those in the museum of Guy's Hospital,) but of being permitted the loan, and full use of his cabinet, which gave me the important opportunity, of instituting more ample experiments, than were at all admissible with the calculi belonging to the Norfolk and Norwich Hospital, where it was of course necessary to be limited to the smallest portion requisite for correct analysis.

I have likewise always found carbonate of lime in combination with phosphate, both in concretions formed in various parts of the body, and in prostatic calculi, (one of which I examined at the College of Surgeons,) although both sets of substances are generally regarded as consisting of phosphate of lime alone. The same observation has been made by Dr. PROUT, as to several similar substances which have come under his notice.

No specimen of cystic or xanthic oxide has yet been found in the Norwich collection.

The calculations which are comprised in this paper, can in many instances, only be regarded as approximating to the truth; and as depending on future, and more extended observation, for greater accuracy and precision. The inquiring disposition of the present age, has made us acquainted with the physical features of the principal parts of the united kingdom, whether in relation to power and variety of production, diversity of scenery, or peculiarities of geological character. A similar degree of talent and energy to that which has been so successfully employed on those objects, may be no less advantageously directed, to an examination of the habits and modes of life, by which the in-

* *Annales de Chimie*, tom. xxxvi. p. 263.

habitants of different districts are distinguished ; to the description and influence of their food ; to the maladies most prevalent among them ; and the effect of their occupations, in producing, or modifying disease. These inquiries would lead to the knowledge of many important facts, which would not only be useful in throwing light on the nature of various obscure complaints, and in particular of those of a calculous description, but would have an extensive and advantageous bearing on general pathology.

I have alluded to a probable connection in towns, between the scrophulous, and the calculous diathesis ; and in the Norfolk district, there is unquestionably a great disposition to every form of scrophula, from a slight enlargement of a submaxillary gland, to the severest states of articular, or pulmonary disease. Whether, however, the disposition is greater than in other counties ; and how far, in this case, it may be connected with the calculous character of the district ; future observations must determine.

Carrow Abbey near Norwich,

June 10, 1828.